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sheds near the building of the Institution, which, being inflammable, are a constant menace to its safety.

The Bureau of Ethnology is continuing its important work in the study of linguistics, habits and customs of the American aborigines, and important explorations have been made during the year under the direction of Mr. McGee among the Seri and Papago Indians, of the far Southwest, and by Dr. J. Walter Fewkes in the ruins of a town near Moqui, which was destroyed by hostile Indians before the first visit of the Spaniards. The latter exploration was the first ever made of a thoroughly pre-Columbian town site, and resulted in the gathering of a collection of pottery and other objects of unequalled beauty and value.

Referring to the Zoölogical Park, Secretary Langley directed attention to the alarming reports which are coming from the Yellowstone National Park, which seem to make it certain that the herd of several hundred buffalo reported last year has been reduced to fifty or less, and indicating that it will soon be destroyed unless steps are taken for its preservation. Since the means at the disposal of the custodians of the Yellowstone National Park seem quite inadequate to protect them, the desirability is suggested of transferring most of the remnant of the herd to Washington, to be placed in the Zoölogical Park, which has amply sufficient space for all that are left.

The work of the Astro-Physical Observatory was referred to, and the researches there being carried on, which are giving us a knowledge of nearly thrice the amount of details of solar energy that were known to Sir Isaac Newton, and in a region which was left almost untouched until our own day when these researches took it up. The number of known lines in this portion of the spectrum has increased from less than twenty to over a thousand owing to the

work which has been carried on in this little observatory during the last four years. The location is a very unfortunate one, however, since the traffic of the street interferes with the proper use of the instruments, and reference was made by the Secretary to a plan for constructing a modest building for this work in some portion of the suburbs where the necessary quiet can be obtained.

The Secretary's report was accepted, as was also that of the Executive Committee.

Letters of acknowledgment were read from the Royal Institute of Great Britain for a portrait of Mr. Hodgkins sent by the Institution, and from the master of Pembroke College in Oxford, where Smithsonian received his degree in 1786, acknowledging the gift of a complete series of the publications of the Institution.

*MEMORIAL TRIBUTE TO PROFESSOR THOMAS H. HUXLEY.**

ALL the members of this Academy, in fact all men of science in America, are in different ways indebted to the late Professor Huxley. We should be ungrateful, indeed, especially in this section of the Academy, if we failed to join in the tributes which are being paid to him in different parts of the world.

In his memory I do not offer a formal address this evening, but, as one of his students, would present some personal reminiscences of his characteristics as a teacher, and some of the striking features of his life and work.

Huxley was born in 1825. Like Goethe, he inherited from his mother his brilliantly alert powers of thought, and from his father his courage and tenacity of purpose, a combination of qualities which especially fitted him for the period in which he was to live. There is nothing striking recorded about his boyhood as a naturalist. He preferred engineering, but was led into medicine.

* Read before the Biological Section of the New York Academy of Sciences, November 11, 1895.

At the close of his medical course he secured a navy medical post upon the 'Rattlesnake.' This brought with it, as to Darwin, the training of a four-years' voyage to the South Seas off eastern Australia and west Guinea—a more liberal education to a naturalist than any university affords, even at the present day. This voyage began at twenty-one, and he says of it: "But, apart from experience of this kind and the opportunity afforded for scientific work to me, personally, the cruise was extremely valuable. It was good for me to live under sharp discipline, to be down on the realities of existence by living on bare necessities, to find out how extremely worth living life seemed to be, when one woke from a night's rest on a soft plank, with the sky for a canopy and cocoa and weevily biscuit the sole prospect for breakfast, and more especially to learn to work for what I got for myself out of it. My brother officers were as good as sailors ought to be and generally are, but naturally they neither knew nor cared anything about my pursuits, nor understood why I should be so zealous in the pursuit of the objects which my friends, the mid-dies, christened 'Buffons,' after the title conspicuous on a volume of the '*Suites a Buffon*,' which stood in a prominent place on my shelf in the chart room."

As the result of this voyage of four years numerous papers were sent home to the Linnæan Society of London, but few were published; upon his return his first great work, *Upon the Anatomy and Affinities of the Medusæ*, was declined for publication by the Admiralty—a fortunate circumstance, for it led to his quitting the navy for good and trusting to his own resources. Upon publication, this memoir at once established his scientific reputation at the early age of twenty-four, just as Richard Owen had won his spurs by his 'Memoir on the Pearly Nautilus.' In 1852 Huxley's preference as a biologist was to turn back to physiology,

which had become the favorite study of his medical course. But his fate was to enter and become distinguished in a widely different branch, which had as little attraction for him as for most students of marine life, namely, paleontology. He says of his sudden change of base:

"At last, in 1854, on the translation of my warm friend, Edward Forbes, to Edinburgh, Sir Henry de la Beche, the Director-General of the Geological Survey, offered me the post Forbes had vacated of Paleontologist and Lecturer on Natural History. I refused the former point-blank, and accepted the latter only provisionally, telling Sir Henry that I did not care for fossils and that I should give up natural history as soon as I could get a physiological post. But I held the office for thirty-one years and a large part of my work has been paleontological."

From this time until 1885 his labors extended over the widest field of biology and of philosophy ever covered by any naturalist, with the single exception of Aristotle. In philosophy Huxley showed rare critical and historical power; he made the most exhaustive study of Hume, but his own philosophical spirit and temper was more directly the offspring of Descartes. Some subjects he mastered, others he merely touched, but every subject which he wrote about he illuminated. Huxley did not discover or first define protoplasm, but he made it known to the English-speaking world as the physical basis of life; recognizing the unity of animal and plant protoplasm. He cleared up certain problems among the *Protozoa*. In 1849 appeared his great work upon the oceanic *Hydrozoa*, and familiarity with these forms doubtless suggested the brilliant comparison of the two-layered gastrula to the adult hydrozoa. He threw light upon the Tunicata, describing the endostyle as a universal feature, but not venturing to raise the Tunicata to a

separate order. He set in order the cephalopod mollusca, deriving the spiral from the straight shelled fossil forms. He contributed to the Arthropoda; his last word upon this group being his charming little volume upon the 'Crayfish,' a model of its kind. But think of the virgin field which opened up before him among the vertebrata, when in 1859 he was the first to perceive the truth of Darwin's theory of descent. Here were Cuvier's and Owen's vast researches upon living and extinct forms, a disorderly chaos of facts waiting for generalization. Huxley was the man for the time. He had already secured a thoroughly philosophical basis for his comparative osteology by studying the new embryology of Von Baer, which Richard Owen had wholly ignored. In 1858 his famous Croonian lecture on the 'Theory of the Vertebrate Skull' gave the death blow to Owen's life work upon the skull and vertebral archetype, and to the whole system of mystical and transcendental anatomy; and now Huxley set to work vigorously to build out of Owen's scattered tribes the great limbs and branches of the vertebrate tree. He set the fishes and batrachia apart as the *Ithyopsidan* branch, the reptiles and birds as the *Sauropsidan* in contrast with the *Mammalian*, which he derived from a pro-sauropsidan or amphibian stem, a theory which with some modification has received strong recent verification.

Prof. Owen, who had held undisputed sway in England up to 1858, fought nobly for opinions which had been idolized in the first half century, but was routed at every point. Huxley captured his last fortress, when, in his famous essay of 1865, 'Man's Place in Nature,' he undermined Owen's teaching of the separate and distinct anatomical position of Man. We can only appreciate Huxley's fighting qualities when we see how strongly Owen was intrenched at the beginning of this long battle royal;

he was director of the British Museum and occupied other high posts; he had the strong moral support of the government and of the royal family, although these were weak allies in a scientific encounter.

Huxley's powers of rapid generalization of course betrayed him frequently; his *Bathybius* was a groundless and short-lived hypothesis; he went far astray in the phylogeny of the horses. But these and other errors were far less attributable to defects in his reasoning powers than to the extraordinarily high pressure under which he worked for the twenty years between 1860 and 1880, when duties upon the Educational Board, upon the Government Fisheries Commission and upon Parliamentary committees crowded upon him. He had at his command none of the resources of modern technique. He cut his own sections. I remember once seeing some of his microscopic sections. To one of our college junior students working with a Minot microtome Huxley's sections would have appeared like translucent beefsteaks—another illustration that it is not always the section which reveals the natural law, but the man who looks at the section.

Huxley was not only a master in the search for truth, but in the way in which he presented it, both in writing and in speaking. And we are assured, largely as he was gifted by nature, his beautifully lucid and interesting style was partly the result of deliberate hard work. He was not born to it; some of his early essays are rather labored; he acquired it. He was familiar with the best Greek literature and restudied the language; he pored over Milton and Carlyle and Mill; he studied the fine old English of the Bible; he took as especial models Hume and Hobbes, until finally he wrote his mother tongue as no other Englishman wrote it. Take up any one of his essays, biological, literary, philosophical, you at once see his central idea and his

main purpose, although he never uses italics or spaced letters, as many of our German masters do to relieve the obscurity of their sentences. We are carried along upon the broad current of his reasoning without being confused by his abundant side illustrations. He gleaned from the literature of all time until his mind was stocked with apt similes. Who but Huxley would have selected the title 'Lay Sermons' for his first volume of addresses; or, in 1880, twenty-one years after Darwin's work appeared, would have entitled his essay upon the influence of this work: 'The Coming of Age of the Origin of Species?' Or to whom else would it have occurred to repeat over the grave of Balfour the exquisitely appropriate lines: 'For Lycidas is dead, dead ere his prime.' Who else could have inveighed thus against modern specialization: "We are in the case of Tarpeia, who opened the gates of the Roman citadel to the Sabines and was crushed by the weight of the reward bestowed upon her. It has become impossible for any man to keep pace with the progress of the whole of any important branch of science. It looks as if the scientific, like other revolutions, meant to devour its own children; as if the growth of science tended to overwhelm its votaries; as if the man of science of the future were condemned to diminish into a narrow specialist as time goes on. It appears to me that the only defense against this tendency to the degeneration of scientific workers lies in the organization and extension of scientific education in such a manner as to secure breadth of culture without superficiality; and, on the other hand, depth and precision of knowledge without narrowness."

Huxley's public addresses always gave the impression of being largely impromptu, but he once told me: "I always think out carefully every word I am going to say. There is no greater danger than the so-called *inspiration of the moment*, which leads

you to say something which is not exactly true, or which you would regret afterward. I sometimes envy your countrymen their readiness and believe that a native American, if summoned out of bed at midnight, could step to his window and speak well upon any subject." I told him I feared he had been slightly misinformed; I feared that many American impromptu speeches were more distinguished by a flow of language than of ideas. But Huxley was sometimes very impressive when he did not speak. In 1879 he was strongly advocating the removal of the Royal School of Mines from crowded Jermyn street to South Kensington, a matter which is still being agitated. At a public dinner given by the alumni of the School, who were naturally attached to the old buildings, the chairman was indiscreet enough to make an attack upon the policy of removal. He was vigorously applauded, when, to every one's consternation, Huxley, who was sitting at the chairman's right, slowly rose, paused a moment, and then silently skirted the tables and walked out of the hall. A solemn pall fell over the remainder of the dinner and we were all glad to find an excuse to leave early.

In personal conversation Huxley was full of humor and greatly enjoyed stories at his own expense. Such was the following: "In my early period as a lecturer I had very little confidence in my general powers, but one thing I prided myself upon was clearness. I was once talking of the brain before a large mixed audience and soon began to feel that no one in the room understood me. Finally I saw the thoroughly interested face of a woman auditor and took consolation in delivering the remainder of the lecture directly to her. At the close, my feeling as to her interest was confirmed when she came up and asked if she might put one question upon a single point which she had not quite understood. 'Certainly,' I replied. 'Now, Professor,' she said, 'is

the cerebellum inside or outside of the skull?" "A story of his about babies is also characteristic: "When a fond mother calls upon me to admire her baby I never fail to respond, and, while cooing appropriately, I take advantage of an opportunity to gently ascertain whether the soles of its feet turn in and tend to support my theory of arboreal descent."

Huxley as a teacher can never be forgotten by any of his students. He entered his lecture room promptly as the clock was striking nine, rather quickly and with his head bent forward 'as if oppressive with its mind.' He usually glanced attention to his class of about ninety and began speaking before he reached his chair. He spoke between his lips, but with perfectly clear analysis, with thorough interest and with philosophic insight, which was far above the average of his students. He used very few charts, but handled the chalk with great skill, sketching out the anatomy of an animal as if it were a transparent object. As in Darwin's face, and as in Erasmus Darwin's or Buffon's, and many other anatomists with a strong sense of form, his eyes were heavily overhung by a projecting forehead and eyebrows and seemed at times to look inward. His lips were firm and closely set, with the expression of positiveness, and the other feature which most marked him was the very heavy mass of hair falling over his forehead, which he would frequently stroke or toss back. Occasionally he would lighten up the monotony of anatomical description by a bit of humor. I remember one instance which was probably reminiscent of his famous tilt with Bishop Wilberforce at the meeting of the British Association in 1860. Huxley was describing the mammalian heart and had just distinguished between the tricuspid valve on the right side of the heart and the bicuspid valve on the left, which you know resembles a bishop's mitre, and hence is known as the

mitral valve. He said, "It is not easy to recall on which side these respective valves are found, but I recommend this rule; you can easily remember that the mitral is on the left, because a bishop is never known to be on the right."

Huxley was the father of modern laboratory instruction, but in 1879 he was so intensely engrossed with his own researches that he very seldom came through the laboratory, which was ably directed by T. Jeffrey Parker, assisted by G. B. Howes and W. Newton Parker, all of whom are now professors, Howes having succeeded to Huxley's chair. Each visit therefore inspired a certain amount of terror, which was really unwarranted, for Huxley always spoke in the kindest tones to his students, although sometimes he could not resist making fun at their expense. There was an Irish student who sat in front of me, whose anatomical drawings in water color were certainly most remarkable productions. Huxley, in turning over his drawing-book, paused at a large blur under which was carefully inscribed 'sheep's liver' and smilingly said, "I am glad to know that is a liver; it reminds me as much of Cologne cathedral in a fog as of anything I have ever seen before." Fortunately the nationality of the student enabled him to fully appreciate the humor.

The greatest event in the winter of 1879 was Darwin's first and only visit to the laboratory. They came in together, Huxley leading slowly down the long, narrow room, pointing out the especial methods of teaching, which he had originated and which are now universally adopted in England and in this country. Darwin was instantly recognized by the class as he entered and sent a thrill of curiosity down the room, for no one present had ever seen him before. There was the widest possible contrast in the two faces. Darwin's grayish-white hair and bushy eyebrows overshadowed the pair of deeply-set blue eyes, which

seemed to image his wonderfully calm and deep vision of nature and at the same time to emit benevolence. Huxley's piercing black eyes and determined and resolute face were full of admiration, and, at the same time, protection of his older friend. He said afterwards, "you know I have to take care of him, in fact, I have always been Darwin's bulldog," and this exactly expressed one of the many relations which existed so long between the two men.

Huxley was not always fortunate in the intellectual calibre of the men to whom he lectured in the Royal School of Mines. Many of the younger generation were studying in the universities, under Balfour at Cambridge, and under Rolleston, at Oxford. However, Saville Kent, C. Lloyd Morgan, George B. Howes, T. Jeffrey Parker and W. Newton Parker are representative biologists who were directly trained by Huxley. Many others, not his students, have expressed the deepest indebtedness to him. Among these especially are Prof. E. Ray Lankester, of Oxford, and Prof. Michael Foster, of Cambridge. Huxley once said that he had 'discovered Foster.' He not only singled men out, but knew how to direct and inspire them to investigate the most pressing problems of the day. As it was, his thirty-one years of lectures would have produced a far greater effect if they had been delivered from an Oxford, Cambridge or Edinburgh chair. In fact, Huxley's whole life would have been different, in some ways more effective, in others less so, if the universities had welcomed the young genius who was looking for a post and even cast his eyes toward America in 1850, but in those early days of classical prestige both seats of learning were dead to the science which it was Huxley's great service in support of Darwin to place beside physics, in the lead of all others in England. Moreover, Oxford, if not Cambridge, could not long have sheltered such a wolf in the fold.

What Haeckel did for evolution in Germany, Huxley did in England. As the earliest and most ardent supporter of Darwin and the theory of descent, it is remarkable that he never gave an unreserved support to the theory of natural selection as all-sufficient. Twenty-five years ago, with his usual penetration and prophetic insight, he showed that the problem of variation might, after all, be the greater problem; and only three years ago, in his 'Romanes Lecture,' he disappointed many of the disciples of Darwin by declaring that natural selection failed to explain the origin of our moral and ethical nature. Whether he was right or wrong, we will not stop to discuss, but consider the still more remarkable conditions of Huxley's relations to the theory of evolution. As expositor, teacher, defender, he was the high priest of evolution. From the first he saw the strong and weak points of the special Darwinian theory; he wrote upon the subject for thirty years, and yet he never contributed a single original or novel idea to it; in other words, Huxley added vastly to the demonstration, but never added to the sum of either theory or working hypothesis, and the contemporary history of the theory proper could be written without mentioning his name. This lack of speculation upon the factors of evolution was true throughout his whole life; in the voyage of the 'Rattlesnake' he says he did not even think of the species problem. His last utterance regarding the causes of evolution appeared in one of the Reviews as a passing criticism of Weismann's finished philosophy, in which he implies that his own philosophy of the causes of evolution was as far off as ever; in other words, Huxley never fully made up his mind or committed himself to any causal theory of development.

Taking the nineteenth century at large, outside of our own circles of biology, Huxley's greatest and most permanent achievement was his victory for free thought. Per-

sonally we may not be agnostic ; we may disagree with much that he has said and written, but we must admire Huxley's valiant services none the less. A reformer must be an extremist, and Huxley was often extreme, but he never said what he did not believe to be true. If it is easy for you and for me to say what we think, in print and out of print now, it is because of the battles fought by such men as Huxley and Haeckel. When Huxley began his great crusade the air was full of religious intolerants, and, what is quite as bad, scientific shams. If Huxley had entered the contest carefully and guardedly, he would have been lost in the enemies' ranks, but he struck right and left with sledge hammer blows, whether it was a high dignity of the Church or of the State. Just before the occasion of one of his greatest contests, that with Gladstone in the pages of the *Contemporary Review*, Huxley was in Switzerland, completely broken down in health and suffering from torpidity of the liver. Gladstone had written one of his characteristically brilliant articles upon the close correspondence between the Order of Creation as revealed in the first chapter of Genesis and the Order of Evolution as shown by modern biology. "When this article reached me," Huxley told me, "I read it through and it made me so angry that I believe it must have acted upon my liver. At all events, when I finished my reply to Gladstone I felt better than I had for months past."

Huxley's last public appearance was at the meeting of the British Association at Oxford. He had been very urgently invited to attend, for, exactly a quarter of a century before, the Association had met at Oxford and Huxley had had his famous encounter with Bishop Wilberforce. It was felt that the anniversary would be an historic one and incomplete without his presence, and so it proved to be. Huxley's especial duty was to second the vote of thanks for the

Marquis of Salisbury's address—one of the invariable formalities of the opening meeting of the Association. The meeting proved to be the greatest one in the history of the Association. The Sheldonian theatre was packed with one of the most distinguished scientific audiences ever brought together, and the address of the Marquis was worthy of the occasion. The whole tenor of it was the unknown in Science. Passing from the unsolved problems of Astronomy, Chemistry and Physics, he came to Biology. With delicate irony he spoke of the '*comforting word, evolution,*' and passing to the Weismannian controversy implied that the diametrically opposed views so frequently expressed nowadays threw the whole process of evolution into doubt. It was only too evident that the Marquis himself found no comfort in Evolution, and even entertained a suspicion as to its probability. It was well worth the whole journey to Oxford to watch Huxley during this portion of the address. In his red doctor-of-laws gown, placed upon his shoulders by the very body of men who had once referred to him as 'a Mr. Huxley,' he sank deeper into his chair upon the very front of the platform and restlessly tapped his foot. His situation was an unenviable one. He had to thank an ex-Prime Minister of England and present Lord Chancellor of Oxford University for an address, the sentiments of which were directly against those he himself had been maintaining for twenty-five years. He said afterwards that when the proofs of the Marquis' address were put in his hands the day before, he realized that he had before him a most delicate and difficult task.

Lord Kelvin, one of the most distinguished living physicists, first moved the vote of thanks, but his reception was nothing to the tremendous applause which greeted Huxley in the heart of that University whose traditional principles he had so long been opposing. Considerable anx-

ity had been felt by his friends lest his voice would fail to fill the theatre, for it had signally failed during the Romanes Lecture delivered in Oxford the year before, but when Huxley arose he reminded you of a venerable gladiator returning to the arena after years of absence. He raised his figure and his voice to its full height, and, with one foot turned over the edge of the step, veiled an unmistakable and vigorous protest in the most gracious and dignified speech of thanks.

Throughout the subsequent special sessions of this meeting Huxley could not appear. He gave the impression of being aged, but not infirm, and no one realized that he had spoken his last word as champion of the law of Evolution. He soon returned to Eastbourne. Early in the winter he contracted the gripe, which passed into pneumonia. He rallied once or twice, and his last effort to complete a reply to Balfour's 'Foundations of Belief' hastened his death, which came upon June 29th, at the age of seventy.

I have endeavored to show in how many ways Huxley was a model for us of the younger generation. In the central hall of the British Museum of Natural History sits in marble the life-size figure of Charles Darwin; upon his right will soon be placed a beautiful statue of Richard Owen, and I know that there are many who will enjoy taking some share in the movement to complete this group with the noble figure of Thomas Henry Huxley.

HENRY F. OSBORN.

COLUMBIA COLLEGE.

ON THE CLASSIFICATION OF MUSEUMS.*

MUSEUMS may best be classified in two ways; by the character of their contents,

*From a paper on 'The Principles of Museum Administration,' read at the meeting of the Museums Association at Newcastle-on-Tyne, England, July 23, 1895. This portion of the paper, in modified form, was read before the Philosophical Society of Washington, January 18, 1896.

and by the purposes for which they are founded.*

Under the first category they may be grouped as follows:

- A. Museums of Art.
- B. Historical Museums.
- C. Anthropological Museums.
- D. Natural History Museums.
- E. Technological Museums.
- F. Commercial Museums.

Under the second category they may be classed as

- G. National Museums.
- H. Local, Provincial or City Museums.
- I. College and School Museums.
- J. Professional or Class Museums.
- K. Museums or Cabinets for special research owned by societies or individuals.

A. Art Museums.

1. The Museum of Art is a depository for the æsthetic products of man's creative genius, such as paintings, sculptures, architecture (so far as it can be shown by models, drawings and structural fragments) and specimens of the illustrative arts (such as engravings) and illustrations of the application of art to decorative uses.

2. The greater art collections illustrate, in a manner peculiarly their own, not only the successive phases in the intellectual progress of the civilized races of man, their sentiments, passions and morals, but also their habits and customs, their dress, implements and the minor accessories of their culture often not otherwise recorded.

3. Museums of art, wherever they may be situated, have a certain general similarity to each other in purpose, contents and method of management. Those which most fully represent the art of the communities

*In the references to special museums nothing has been further from my idea than to catalogue existing museums. Many of the most important are not even referred to by name. I have spoken only of those which are especially familiar to myself and which seem best to illustrate the idea in connection with which they are named.